

**“NUTRITIVE VALUE OF FOOD CONSUMED BY
PREGNANT AND LACTATING MOTHERS AND
THEIR IMPACT ON NEW BORN”**

**A
THESIS**

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This is to certify that **Mrs. Neeru Bala** has conducted research work under my supervision on the topic entitled "**Nutritive Value of foods consumed by pregnant and lactating mothers and its impact on new born,**" for the award of the Degree of Doctor of Philosophy in Food Science and Applied Nutrition of the Allahabad University. To the best of my knowledge, the data presented in the thesis are genuine and original.

December, 2002
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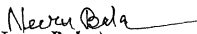
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CHAPTER - I

INTRODUCTION

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INTRODUCTION

In spite of the changing scenario of status of women throughout the world in different cultures, women's status still largely depends on the biological fact at any given time. The woman is the bearer of children, whose care at infancy stage is usually her responsibility. It is a fact that there are wide cultural variations in child care practice. Childcare is mostly women oriented. In this era, we may boast ourselves in saying that women and children always bear more than their share of poverty, no effort has been made to improve the status of women and children. The local, national and international organizations should work together to improve the nutrition and education of children.

In the changing world, women play different roles not only in family management but managerial role of a nurse to the sick family members and role of teacher to their children. So, it is important that women should be in a good healthy condition, well nourished through balanced diet and adequate exercise in a happy environment.

In order to be reared as a healthy Citizen, it is important to have a healthy foetus. During pregnancy, it is important that women take good care of themselves. A well-nourished woman generally delivers a well nourished baby and she has ample supply of milk with useful nutrients to the breast-fed child. It is reported that women with

chronic malnutrition before pregnancy delivers low birth weight babies and women, thus, play an important role in the health of the babies and of entire family.

Scenario in underdeveloped Region

For the most women in the underdeveloped world, pregnancy and lactation are amongst the most stressful periods when women sustain a rapidly growing foetus often under hostile conditions of poverty and overwork. Thus, in nutritional jargon pregnant and lactating women besides infants and children are said to belong to the vulnerable groups.

Pregnancy makes many demands on the prospective mother, not the least of which are her nutritional needs and those are the unborn infant. Although undernourished mother may produce a healthy child, studies of nutrition of women during pregnancy have shown a definite relationship between the diet of the mother may produce a healthy child, studies of nutrition of women during pregnancy have shown a definite relationship with malformation, pre-maturity and present system of medicine came into being however, scientific interest on the consequences of maternal malnutrition on the mother child increased substantially after the experience of the two world wars.

The need of appropriate link between a mother and her child in any part of the world has been emphasized by the very label 'MCH' In less developed areas of the world, this biological and logistic link

becomes not only important but vital and is imperative for health and even survival.

The nutrition of the mother in pregnancy is reflected not only by the birth weight and maturity of her baby but also by his stores of iron vitamins and other nutrients needed for the early period of infancy. Even more important is the need for a live vigorous, lactating mother to feed. Carry and care for the infant during this period as an extrauterine foetus. Bottle feeding may be virtually a sentence of death.

NUTRITIONAL REQUIREMENTS DURING PREGNANCY:

Energy requirement :

In the physical activity of the women remains the same during the second and third trimesters of pregnancy, an additional 300 calories daily is suggested to meet the gross energy cost of 80,000 Kcal for a 9-month pregnancy. The building of new tissues in the woman, the placenta and the foetus, an increased workload associated with the activity of the woman, and an increased basal metabolic rate contribute to increased energy needs. Nutrition intervention in the form of food supplements providing additional calories resulted in an increase of the average birth weights of infants born to malnourished mothers. However, among well-nourished women decreased physical activity, particularly during the third trimester may be more than compensate, to the point that no additional calories may be needed.

The energy requirement during lactation is computed from the energy cost of lactation and would take into account volume of milk secreted, Its energy content and the efficiency of conversion of food energy into milk energy. Assuming an optimal output of 850 ml. (FAO/WHO. expert group 1973) and conversion efficiency of 80% the additional intake of energy recommended during lactation by 9CMR (1989) is 550 Kcal per day for first 6 months. Since, Indian women continue to lactate beyond 6 months with reduced milk output, an extra allowance of 400 Kcal per day was recommended for period 6 months to 1 year.

Protein Requirement :

The protein intake must be increased during pregnancy due to its specific contributions to growth and more so since a diet low in protein is lacking in other nutrients.

The additional protein requirement during pregnancy is mainly due to accretion of protein by the foetus which is around 1000g. For the entire pregnancy. Women who are chronically undernourished and underweight those with infections and infestations and adolescent pregnant women, may require extra proteins and calories for replation of tissue proteins to enable them to withstand the stress of pregnancy and lactation.

The protein content of milk is not influenced by maternal diet and is remarkably low in human milk (around 0.8-1.2 mg per 100 ml)

with no significant difference between well- nourished and malnourished lactating women.

The protein requirement for lactation has been calculated on the basis of the quantity of protein in milk after the first month (1.15g per 100ml) and conversion efficiency from dietary protein. Since tissue protein accretion in lactation is significant, this is not used for calculating extra requirement for lactation. Based on the optimum milk volume of 850 ml per day, WHO suggested an extra protein intake of about 16g per day during first second 6 months and 11.0 g per day thereafter. ICMR recommendation is 25g per day for first 6 months and 18 g per day from 6-12 months.

Calcium- need :

The calcium requirement during pregnancy is mainly that for the growth of the foetus. The total pregnancy requirement of calcium is about 30g of which the term foetus occurs 27.5g, the placenta 1.0g and the maternal fluids and tissues about 1.0g since, most of the foetal growth occurs in the third trimester, it is proposed that 0.5-0.6g of calcium be added to the daily requirement of 0.4 g for the non-pregnant state and a total of 1.0-1.2 g of calcium be given in the 2nd half of pregnancy.

The calcium content of breast milk lies more than average 300mg/ litre in established lactation. IN order to meet this need, a total allowance of 1200mg calcium is recommended for the lactating women.

Iron requirement :

An adequate iron supply during pregnancy is no less important than that of calcium. Besides the woman's need for iron, the developing foetus is building its own blood supply. When the baby is born its blood has a hemoglobin content of from 20.0g to 22.0g per 100ml. This high level is needed in foetal life for oxygen uptake at the placenta where oxygen is at lower pressures than it is in the lungs. Soon after birth some of the hemoglobin begins to break down until a normal level of 13g to 14g per 100ml of blood is reached. The iron from the hemoglobin breakdown is stored in the infants liver to secure as a supply during the first few months of life when the diet of milk provides little iron. If the women's intake of iron is low, this is reflected in the level of her own hemoglobin.

Iodine requirement :

Iodine is also an important element in the diet of the pregnant woman. An additional quantity 25 mcg. Of iodine per day is also recommended during pregnancy. A deficiency of this element during pregnancy may cause goiter in the pregnant woman. The use of iodized salt is suggested for those who live in areas where the soil and the drinking water are known to be deficient in iodine.

Zinc requirement :

An additional 5 mg of zinc per day is recommended during pregnancy. It is based on the calculated additional 0.75 mg required daily for growth of the foetus and placenta.

Vitamin Supplement :

Nutritional assessment studies indicate increased need during pregnancy for thiamin, riboflavin and niacin. The increased requirement for protein necessitates an increase in vitamin B6 of 0.6 mg per day for the pregnant women. The added allowance of 1 mcg. Per day of vitamin B12 for the pregnant woman is based on total demands and the increased metabolic needs of the others.

The vitamin A allowance is increased 200 RE during pregnancy to compensate for the storage of vitamin A in the fetus.

Weight gain during pregnancy :

A healthy woman gains on an average about 11-12 kg during pregnancy. The usual pattern of weight gain consists of a minimal gain of 1-2 kg during the first trimester and a more or less, linear rate of 0.4 kg/week in the second and third trimester.

Human milk is the most appropriate of all available milk for the human infant. It is uniquely adapted to his or her need. Breastfeeding needs maternal confidence. If the mother is not confident enough or insecure there may be a failure in breast feeding. So it is important that health care workers talk to the expecting mother and advice them regarding breast feeding periodically. Again after delivery the health care providers should provide technical help to the mother and the baby so that breast feeding is comfortable and is a sense of accomplishment for the mother. It is more practical and has psychological advantage. Since mother is personally involved in the

nuturing of the baby she has the feeling of being indispensable towards proper growth of the child. In those situations where the nutrition of the entire family is poor, and if they are in poverty line the mother may not have adequate supply of milk and what ever she has may not provide adequate calories and other nutrients. In those situations the babies have only two choices one is taking in adequate supply of mother's milk and the second one is starvation. Hence, breast feeding is vital and is the only source of energy for children.

Diet in lactation :

Lactation makes even greater demands in some respects on the maternal organism than does pregnancy. After birth, the child still may be fed from the mother's body, the food now being supplied through the blood stream, as before birth, as the infant gain in weight and becomes increasingly active, the food supply from the mother must increase.

Dietary requirements :

The recommended dietary allowance (RDA) for energy for the nursing mother producing 850 ml of milk daily in 500 additional calories above her normal needs for the first 3 months of lactation. This recommendation is based on the 80% efficiency with which maternal dietary energy is converted into energy in milk. The production of 100 ml of milk requires approximately 90 kcal. Besides the increased in energy requirement, there are also increases in the requirements for protein, minerals and vitamins. To cover the needs of milk production and to allow for 70% efficiency of protein utilization,

an additional 20 g of protein is recommended. Similarly, vitamins and minerals which are to be used in milk production must be supplied in adequate amounts as the mother's own tissues may become depleted, supplements of vitamin A, vitamin C, thiamin, and riboflavin given to malnourished mothers have resulted in increased amounts of these nutrients in the milk.

Despite wide spread nutritional food available both in rural and urban sectors of the country, no nutrition education efforts have been made in educating the rural mass particularly women for adequate diet. This has resulted in nutritional disorder and impaired health of pregnant and lactating mothers with consequent in the poor body weight and unsound health of the new born. Many people still do not know enough about nutritive value of food available in plenty to make food choices. The present investigation has, therefore, been aimed in this direction with the following objectives :

- 1) To conduct sample survey of women to assess the choices of food consumption.
- 2) To study the effect of nutritive value of food on the health of pregnant and lactating mothers.
- 3) To compare the intake of food stuffs and compare the standard food value and.
- 4) To study the impact of food stuff of consuming women on the health of new born.

Hypothesis :

- 1) The nutritional status of pregnant and lactating mothers of low income group will be inferior in comparison to standard dietary allowance of higher income group.
- 2) The birth weight of infants likewise would be less than standard birth weight.
- 3) Level of education plays an important role in enhancing the nutritional status of women and its effect on birth weight.

Lactating mothers problem and perspectives :

Though lactation is a normal physiological process, it makes considerable nutrition demands in the mother. The physiological developments for lactation begins during later part of pregnancy. Apart from the growth and development of mammary glands, the fat in the body of the mother provides extra energy requirement during lactation.

Lactation has high relevance to the growth and health of infants. Mothers milk has been regarded the best food for infants in the first month of life. The chemical comparison seems to be the most appropriate for the needs of the infants.

Indicators of adequate lactation :

The sample indicator of the adequate of breast feeding is the normal rate of increase in the body of infants. Although, it is difficult to define the ideal growth curve. However, for practical purposes weight of 800 ± 20 g per month during the first six months of life may be regarded as optimal.

Milk yield of mothers are affected by age, status of health, nutrition of mother and duration of lactation. It is essential to measure the milk yield of mothers for which two techniques have been found useful :

1. To weigh the child before and after each feed.
2. To empty the breast by hand mechanically.

The mother's diet and nutritional level are very effective factors in the composition and output of milk. The studies carried out by Deem (1931) are of considerable importance since these were done under controlled condition.

Nutritional requirement :

The WHO expert committee assumed the optimal daily output of mother's milk to be 850 ml which could provide the following food values :

Composition of Mother's Milk (Based on 850 ml volume) :

Ingredients	Values
Energy (Kcal)	600
Protein (g)	10.2
Calcium (mg)	290
Iron (mg)	0.25-3.1
Vitamin A (mg)	420
Ascorbic Acid	22-44
Niacin (mg)	1.6
Riboflavin (mg)	0.52
Thiamin	0.12
B12 (μ g)	0.2

CHAPTER - II

REVIEW OF LITERATURE

CHAPTER - II

REVIEW OF LITERATURE

In planning for nutritional adequacy during pregnancy, it is important to keep the increases in the nutrient intake as per dietary allowance recommended by Indian Council of Medical Research (ICMR). Food components meeting the criteria for classification as current public health issues are :

- a) Food energy
- b) Food fat
- c) Saturated fatty acids
- d) Cholesterol, alcohol
- e) Iron, calcium and sodium

Except for iron and calcium, these food components were as classified current public health issues because of evidence of adverse effects of high intakes.

The committee on maternal nutrition (1970) in their report emphasized that preconception about nutritional status appears to have an important bearing on the course and outcome of pregnancy. A woman who has a history of good nutritional status and is well nourished at the time of conception has an increased chance of delivering a healthy term baby of advantages. This provides a safe margin for women who has just become pregnant.

U.S. General Accounting Office (GAO) 1994. Nutrition monitoring and coordinated programme, Washington, D.C.

Data on the dietary intakes of pregnant women indicate that mean intakes from food were lower than recommended levels for several key nutrients (GAO, 1994).

2.1 Dietary Status :

Data collected in the NNMRRD Surveys are surveillance systems provide information on the dietary status of the U.S. population. The dietary status has been assessed determining the types and amounts of food, food components, and nutrients consumed. In the evaluation of total nutrient intake both food and non-food nutrient sources are considered.

A balanced diet is one which contains different types of foods in such quantities are proportion that the need for calories, mineral, vitamin and other nutrients are adequately met and a small provision is made for extra nutrients. Taking into account the foods which commonly form Indian balanced diet have been suggested for various groups of population.

For pregnant women whose diet has confirmed has confirmed to the BASIC FIVE FOODS pattern, is merely a matter of emphasizing the more nutrient dense foods within each of the five food groups. Usually, a diet containing three cups of milk or its equivalent, two servings of meat, fish, poultry egg or a source of complete protein, a dark green or yellow vegetables and a general serving of citrus fruits

Dietetics (1995) Nutrition and food requirement of expectatnt mother, Rajshree Pub. New Delhi.

would provide a foundation for a nutritionally adequate diet. Between the sixth to fourteenth week of pregnancy, 75% of women suffer from nausea which in turn affects their appetite. The consumption of small and frequent meals at regular intervals are helpful to many women. This is particularly more helpful in the later part of pregnancy when discomfort is experienced (Dietetics, 1995).

The selection of food is sometimes complicated as women experience strong food dislikes and craving. Most often, they care for foods which they do not ordinarily like and, thus, develop strong distastes for food they previously liked. In certain cases, the aroma or sight of foods may evoke strong reactions. Such cases are encountered towards foods that have no nutritional consequence. But, if the dislike is for food such as milk which is rich in calcium, attention should be directed towards such an issue (Dietetics, 1995).

Recommended dietary allowance of an expectant mother.

Nutrients	Adult women (Normal)	Pregnant women
Energy (Kcal)	1875	+300
Sedentary	2225	+300
Moderate heavy	2925	+300
Protein (g)	50	+15
Fat (g)	20	30
Calcium (mg)	400	1000
Iron (mg)	30	38
Beta-carotene (µg)	2400	2400
Thiamine (mg)		
Sedentary	0.9	+0.2
Moderate	1.1	+0.2
Heavy	1.2	+0.2

Nutrients	Adult women (Normal)	Pregnant women
Riboflavin (mg)		
Sedentary	1.1	+0.2
Moderate	1.3	+0.2
Heavy	1.5	+0.2
Niacin (mg)		
Sedentary	12	+2
Moderate	14	+2
Heavy	16	+2
Pyridoxine (mg)	2.0	2.5
Ascorbic acid (mg)	40	40
Folic acid (mg)	100	400
Vitamin B ₁₂	1	1

2.2 Total calories recommended :

The ICMR recommendation of calorie requirement of pregnant women.

Sedentary worker	1875 + 300	= 2175
Moderate worker	2225 + 300	= 2525
Heavy worker	2925 + 300	= 3225

The calorie requirement of a pregnant woman is mostly increased in the later half of pregnancy. The increase in calorie for trimester were is as follows :-

1st trimester	10 Cals/day
2nd trimester	90 Cals/day
3rd trimester	200 Cals/day

2.2.1 Requirement of Nutrient :

Despite increasing interest in defining basic biological roles of mineral elements and functions in the diets of pregnant and lactating

mothers, etiology of chronic diseases is quite limited. These limitations can not be ascribed to a lack of available analytical methods for their measurements in foods consumed by women, however, their utilization in the daily diets. Traditionally assessment of trace elements in the nutrition status has included indices of growth but recently has relied measurement of element concentration in the fluid and cells in the blood.

Physiological Function :

Knowledge of the biological roles played by carbohydrate, protein, fat, and mineral elements throws some insight into their need for sound health of women.

2.2.2 Carbohydrates :

It provides energy for immediate use of the body (4 Kcal g^{-1}) of carbohydrate. It has been found that total body store of carbohydrate is about 300 g, hence, 1200 Kcal is derived which is enough to last for few hours.

2.2.3 Protein :

The nutritional needs of Indian are met when they follow the traditional vegetarian/non-vegetarian dietary pattern. In an traditional diet, a number of fermented foods are made which not only add variety but also important nutrients. Legumes, especially, the pulses constitute an important source of protein in daily diet consumed by rural and urban people. According to report of ICMR (1993), optimum requirements of the pulses per capita for maintaining normal health is 10 g day^{-1} .

Sharma et al (1977) analysed Arhar (Pigeon pea) for their protein and mineral content which provides protein consumed by majority of population.

Aliya and Geervani (1981) reported that fermentation reduced total crude protein by 6-8% in the legume products and 4-6% in the millet products of Bajra and Ragi but the true digestibility (TD) of legumes products were not altered by fermentation. The biological value (BV) and net protein utilization (NPU) of Bengal gram improved significantly.

Arora (1982) reported 20-30% protein and about 60% carbohydrates and fairly good amount of thamin, nicotinic acid, calcium and iron in pulses.

Kaur and Heera (1988) reported considerable loss in cystine, available lysine, trypsin on cooking. The losses were more in paratha than chapati. The reports published by Gopalan et al. (1996) on the ability of the world for nourishing its ever increasing population has kindled a keen awareness regarding the nutritive value of foods.

Kelkar et al (1996) studied effect of processing methods such as cooking, roasting, fermentation, germination and soaking of green gram, red gram Bengal gram, black gram and reported that digestibility improved in the fermented product of cereals.

2.3 Nutrition and Health Status :

The nutritional and health status of the women both in adolescence and the pre-pregnancy stage as well as during pregnancy are important indicators of complications, numerous studies confirm the relatively poor nutritional and health status of young women. Leading outcomes of poor nutrition and health include women's physical stature and anaemia.

During pregnancy, malnutrition can increase and beliefs and practices lead to encourage eating down. That is reducing women's already meagre average daily food intake and discourage intake of such food items as leafy vegetables during pregnancy. Sometimes, cultural and economic priorities deny them access to better nutrition. This leads to low body weight of pregnant women and the birth weight of new born. Further, poor nutritional status also leads to repeated miscarriages and foetal wastage. Adolescent mothers are also more likely to give birth to low birth weight and preterm babies.

Lehtig et al (1975) found that there were significantly fewer low birth weight (LBW) babies in the high supplemented group than in the low supplemented one.

Keeping et al (1979) and Sundar Lal (1985) observed that birth weight of infants was directly proportional to the socio-economic status of the parents.

Achar and Wankaner (1962) and WHO in 1970 reported increased incidence of prenatal mortality in the lower socio-economic groups. Dougherty and Jones (1982) reported that education of mothers has also a positive influence over birth weight.

Roedor (1973) found that diminished nutrient supply during the critical development period leads to developmental retardation of various organs.

Shah and Shah (1972) observed that maternal malnutrition in the development of small placenta. In another study Raina Neera (1980) observed that birth weight of new born to vegetarian mothers was less as compared to non-vegetarians.

The importance of body weight was indicated by Ramalinga Swami (1985) who suggested that no mother weighing less than 40 kilogram be allowed to be pregnant.

Krishnamurthy (1994) observed that maternal and nutrition and inadequate health care of pregnant women contribute to premature low birth weight babies. He further observed that well nourished women deliver a well nourished baby. However, contrary to this women with chronic malnutrition delivered low birth weight babies.

2.3.1 Nutritional requirement during Lactation :

During lactation, the strain on maternal folate reserves is around 20 $\mu\text{g day}^{-1}$ varying with the folic acid content and volume of milk. The

RDA for folacin during lactation has been suggested as 500 μg National Research Council, USA. Then folic acid content of breast milk of Indian women is 16 ng ml^{-1} , a figure much lower than 30 ng ml^{-1} reported from the west. At higher level of milk secretion, the amount of folate lost by the mother would be 25 $\mu\text{g day}^{-1}$. Additional allowances of 50 $\mu\text{g day}^{-1}$ has been provided for lactation by the ICMR.

2.3.2 Food and Lactation :

The quality of food consumed by mothers during lactation has important bearing on initiation of lactation, milk volume, composition of milk, protein synthesis and hormonal control of milk secretion. The under nourished and well nourished mothers secrete milk which differ in protein, fat, minerals and vitamins.

Various methods have been adopted to measure the milk output. These are :

- a) Test feeding involving weighing of infant before and after feeding.
- b) Measurement of the volume of milk.
- c) Administration of deuterium oxide (D_2O) or other stable isotopes to the mother and excretion of D_2O in the serum or saliva of mothers and infants.

Studies carried out in some cities show that milk output of undernourished women is also satisfactory and adequate to meet the calorie needs of infants in the first 4-6 months. The poor diet did not affect the output. However, recent studies have brought

about this fact that growth of infants is related to the maternal body weight. Women with less body weight do not show satisfactory lactation performance.

2.4 Composition of Milk :

Variations have been observed on the composition of milk. There are individual variations among the lactating mothers.

The protein content of milk are specific to mammary, secretion. Maternal under nutrition is a major factor in infrastructure growth retardation (IUGR). When supplemented with extra-calories, there is possibility to increase the birth weight and, thus, reduction in incidence of low birth may be avoided.

2.4.1 Dietary Status :

Dietary status assessment in the determination of types and amounts of foods, food components and nutrients consumed. It is also important to note that both food and non-food nutrient sources are considered.

The consumption of food by women of low, medium and high income groups is different in quantity and quality also. In the case of women of rural areas with little access to market place are deprived of fresh vegetables, fruits, eggs, meat. The low income women are most affected and, thus, they consume small quantities of these food stuffs in their daily diets. Not much study has been done on this aspect.

2.4.2 Monitoring Needs :

Not much study has been done on the monitoring needs for the intakes from foods and dietary supplements for all of the food components. In addition to food components that are health issues to the lactating mothers the programme should monitor appropriate anthropometric, biochemical and clinical indices of foods consumed by both categories of women viz. pregnant and lactating mothers.

2.4.3 Food Consumption :

Recent research work conducted by Verma and Khadi (2001) reveal that the foods consumed during lactation comprise of different food stuff at Hissar, Ludhiana, Hyderabad and Dharwar. The two centers, at Hissar and Ludhiana consisted of family diets whereas at Hyderabad the foods composed of Garlic powder, tomato, meat, Dhal vegetables (Bhindi), snake gourd, Beans), milk, eggs, family diet, tea and chapati. The foods consumed by lactating mothers at Dharwad comprised of dry coconut and jaggery, roasted garlic, methi seeds, ghee, garden cress (Alavi), methi seeds chutney powder, liquor (muslim and lambaris only), egg, meat besides family diet.

2.5 Foods Avoided :

The above four centers were also included in the study of foods generally avoided by this category of women.

Hyderabad

Brinjal. Bottlegourd.
Ridge gourd. Curds an
butter milk. potato. re
gram dhal. spices.

Dharwad

Brinja. Potato. Sweet potato.
Cucumber. Jack fruit. Radish.
Pumpkin. Green Chillies. Green
Vegetables. Spices. Banana.
Papaya. Bengal Gram Dhal. Oil
and Oil products.

Hissar

Black Gram, Dhal.
Curd and Butter Milk.
Chholia.

Pantnagar

Black Gram Dhal. Kathal
(Jack fruit).

2.5.1 Requirement of Nutrients :

a) Carbohydrate and Constituents :

The total carbohydrates in dietary fibre (a carbohydrate constituent) are generally lower in the intake of foods consumed by pregnant and lactating mothers caused by poverty and illiteracy. In high income groups, the quantities of fruits, vegetables and grain products which contain complex carbohydrates including dietary fibre is high. These are sufficient and are associated with maintenance of health. Higher intakes of soluble and insoluble fibre fractions have been associated with lower serum cholesterol levels and lower risk of diseases. The consumption of carbohydrate containing foods need to be monitored.

Sugars likewise provide energy and may displace other sources of nutrients. However, the consumption of sucrose in particular is also associated with development of dental caries. It has been seen that when the fat content of food is reduced, the sugar content may increase and result in higher intakes of sugars by people who consume fat-free, low-fat or reduced fat foods. It is advisable, therefore, to replace fat.

2.5.2 Fats and Oils – (Poly unsaturated and mono unsaturated fatty acids)

It is of interest and concern for medium intakes of polyunsaturated and saturated fatty acids within recommended ranges ($\leq 10\%$ of calories and $\leq 15\%$ of calories) respectively. The recommended dietary allowance Food and Nutrition Board, USA (1980) advocated.

Gopalan, C (1971) has expressed his views that adequate nutrition to our infants and children should receive the highest priority. He has found that infants are malnourished and high percentage of them succumb to death and those who survive bear subtle mental and physical scars of malnutrition.

F.A.O. (1963) report also stressed the responsibilities of developing countries for production and distribution of protective foods to the vulnerable groups. The study was an attempt to study the nutritional

status of vulnerable group i.e., nursing mothers in an applied nutrition programme.

Parpia et. al. (1957) found protein malnutrition anaemia and vitamin deficiency widely prevalent in infants. Belavady (1969) is of opinion that lactation makes considerable nutritional demands on the mothers.

Lyenger, L (1967) found lactating mothers and pregnant women most adversely affected and suggested for improvement of the diet of this group.

Bhatia et. al. (1988) studied cases of 341 primiparous women. Mothers subjected to weight, height, head circumference measurement as well as haemoglobin and serum albumin estimations. The percent distribution and percentiles values of various nutritional status of primiparous women. Both anthropometric and biochemical nutritional indicators were found to be independent variables as one group of parameters did not influence the inter relationship of other group of parameters.

Metzger et. al. (1982) reported that fasting during pregnancy could more rapid fall of plasma glucose compared to normal females. This is probably because the glycogenic amino acid alanine required by the foetus is not available that fat should not provide more than 35% of dietary energy.

2.5.3 Antioxidat Vitamins (Vitamin C and Vitamin E) :

Epidemiological and clinical studies suggest that these vitamins in food is necessary for proper health maintenance. These are needed in diets of pregnant women as the presence of these lower the risk of cataracts and muscular degeneration also leading to visual loss in majority of women taking poor diets devoid of these values.

2.5.4 Water-Soluble Vitamin (Folate and Vitmin 12):

The Indian Council of Medical Research (ICMR) has recommended 400 mcg day⁻¹ of folic acid for pregnant women for promoting normal foetal growth and preventing macrocytic anaemia of pregnancy. It is needed for synthesis of essential components of DNA and RNA. Its deficiency is of major concern. It has been found that vegetarian mothers are subjected to high chances of suffering from vitamin B-12 deficiency.

Dougherty and Jones (1982) reported that education of mothers has a positive influence on the birth weight of new born. The studies conducted by Naiye *et. al.* (1973) has shown that malnutrition in early and mid pregnancy had less effect on total growth but if continued up to late pregnancy results in pronounced effect on foetal growth.

Felig (1973) found that fasting increases endogenous fat metabolism of the mother and instead of glucose, the fetus is obliged to utilize peptones for energy. Maternal ketosis adversely affects fetus metabolism and development. Hence, severe restriction of calories during pregnancy to reduce weight is harmful.

According to Sexton and Hebed (1984) on the basis of some research work established that women who stopped smoking prior to pregnancy or soon after on set of pregnancy produced heavier infants compared to those who continued smoking. In a similar study, Kline *et. al.* (1977) found that smoking may harm the fetus due to nicotine, carbon monoxide (Co) or cyanide, smoking during pregnancy lowers mean birth weight, raised the risk of prenatal mortality and predisposes to spontaneous abortion.

McCormick (1985) found that under weight in pregnant women results in premature rupture and under weight infant. Low birth weight infants has higher risk of death compared to a normal weight infants. Wise *et. al.* (1985) stated that pregnancy being an anabolic process, gets all nourishment from mother, hence, if nutrition of the mother is inadequate than her body reserves are drawn upon and depleted.

Prentice *et. al.* (1984) on the other hand found that prenatal dietary supplement of malnourished women improved fetal birth weight.

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CHAPTER - III

MATERIALS AND METHODS

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The present study pertaining to the topic “Nutritive value of foods consumed by pregnant and lactating mother and their impact on new born” was carried out with the over all clear objectives. The problems aimed was first to find out the types of foods consumed by three categories of women viz. low income, middle income and high income groups for pregnant and lactating mothers and compare the values with the recommended values for these two types of women and secondly, to study the impact of quality of foods on the birth weight and clinical observations of new born.

3.1 Collection of material data :

First of all, a questionnaire was prepared to collect data on different types of foods consumed by pregnant and lactating mothers under three income groups viz. low, middle and high groups.

3.1.1 Location of Sites :

Two sites were selected for the present investigation. First site - Chaka Block, Allahabad, second site - Two city hospitals viz. Kamla Nehru Hospital, Allahabad and Tilak Hospital, Allahabad.

Cooked food materials :

The various types of cooked food items consumed by pregnant and lactating mothers in two income groups were photographed.

These have been included in the thesis in the form of plates (1-13) alongwith the phtotograph of balanced food items.

3.1.2Details of location sites :

a) Chaka Block, Allahabad –

Chaka Block is situated in the Southern part of Allahabad district with 146 villages. The area of the block is 28709.4 hectares. The block office is situated at a distance of 10-12 km. from tehsil Karchchana and has an area of 87707 hectares with a total population of 96759.

b) Hospitals

- 1) Kamla Nehru Hospital
- 2) Tilak Hospital

The Kamla Nehru Hospital is situated in the city of Allahabad near Anand Bhawan in the Northern part of the city. The Tialk Hospital is also situated in Allahabad city of Daraganj area.

3.1.3Dietary Survey :

One hundred fifty pregnant and lactating mothers were selected randomly for the present study from three different sites described earlier. The respondents were closely monitered for the entire study pertaining to the objectives of the investigation The respondents were subjected to various studies and collection of data of their own and their new born during the entire course of the period under study.

3.2 Anthropometric Measurements :

The anthropometric measurements of both categories represented same respondents. This type observation included height, weight and length of new born babies. The methods were followed as advocated by ICMR.

Crown-wheel length was measured on an Infantometer after completely stitching the infant. The weight measurement was taken on a krup weighing machine. The height measurement of pregnant women was recorded with the help of a measuring tape.

3.2.1 Haemoglobin (Hb) :

Haemoglobin percentage of the respondents was obtained from the hospitals maintained in the record files.

3.2.2 Carbohydrate :

The total carbohydrate content in foods was determined as advocated by :

Yam and Willis (1954). Accordingly, 1g. of dried sample was transferred to 100 ml stoppered measuring cylinder to which 10 ml of distilled water was added to it and stirred with long glass rod to disperse the sample thoroughly. Thereafter, 13 ml of 52% perchloric acid was added and occasionally stirred for 20 minutes which was made upto to 100 ml. The contents were filtered with whatman No. 42

F.P. into a 250 ml Volumetric flask. The 10 ml of the sample extract was diluted to 10 ml and proceeded as below :

1. Filtrate in duplicate was pipetted into separate test tubes.
2. Duplicate blank (1 ml distilled H₂O) was taken in another tube.
3. Standard in duplicate using 1 ml of standard glucose (100 mg L⁻¹) was pipetted into separate test tubes.
4. 5 ml of Anthrone reagent (0.1%) in concentrate H₂SO₄ was added into all the test tubes.

The test tubes were kept in a water bath for 12 minutes for colour development which was read at 630 n on spectronic -20 after cooling.

$$\text{Total Carbohydrate} = \frac{25 \times \text{O.D. of standard}}{\text{O.D. sample} \times \text{weight of sample}}$$

3.2.3 Protein :

Protein content was determined by conventional micro-kjeldahl method (A.O.A.C., 1970). The sample was digested in the presence of catalyst mixture (K₂SO₄ plus CuSO₄) and concentration H₂SO₄. The digested material was transferred to distillation flask. Then, 20 ml of 0.1 NHCl was taken in a 250 erlenmeyer flask to which 2-3 drops of mixed indicator was added. Care was taken to start the distillation just after the addition of 40% NaOH to the distillation flask.

$$\text{Protein (\%)} = \frac{\text{CTV} \times 0.0014 \times 6.25 \times 100}{\text{Weight of sample}}$$

CTV = Value of 0.1N NaOH observed by liberated NH_3 .

3.2.4 Calcium :

Versenate (EDTA method)

Reagents :

- a) $\text{NH}_4\text{Cl} - \text{NH}_4 - \text{OH}$ buffer
- b) 0.01 N CaCl_2
- c) 0.01 N EDTA solution
- d) Ammo. Purpurate Indicator

The content of calcium in food stuffs were estimated after digestion with trichloro acid mixture. After standardization of CaCl_2 solution against EDTA, the sample aliquot is taken in 50 ml capacity beaker to which buffer solution was added to make the solution alkaline. After this, a pinch of indicator was added and titrated against the standard versenate solution till purple colour persists.

The content was calculated as per method advocated by Jackson (1978).

3.2.5 Vitamin A (Carotene)

Reagents :

- e) Acetone – Dry (Alcohol free)
- f) Hexane – B.P. 60-70°

- g) Activated magnesia – micron brand
- h) Diatomaceous earth – Hyflo-super-cel.

Extraction :

The material was balanced in boiling water for 5-10 minutes and stored in frozen condition. 5 g. of this sample was weighed and placed in a high speed blender with 40 ml acetone, 60 ml hexane and 0.1 g. MgCo_3 and it was then blended for 5 minutes. This mixture was then filtered and washed with 25 ml. Portion of acetone, then with 25 ml. Hexane. Bother extracts were combined. The acetone was washed from both the extracts from the extracts with 500 ml. distilled water and upper layer was transferred to 100 ml volumetric flask containing 9 ml. acetone and diluted to the volume with hexane.

Separation of pigments :

A chromatographic column was prepared with 1:1 mixture magnesia and diatomaceous earth to prepare the column, small glass wool plug was placed inside the tube and full vacuum of H_2O pump was applied. Thus, packed column was made 10 cm. Deep, 1 cm layer of anhydride Na_2SO_4 was placed above the adsorbent. The top of the column was covered with layer of the solvent during entire operation.

The absorbance of the extract was immediately determined by klett summerson spectrophotometer using No. 44 filter. The instrument was already calibrated with the solution of high purity B-carotene and the absorbance curve was prepared and absorbance of

the sample solution was converted to the carotene concentration from the very chart.

$$\text{B-carotene} = \frac{\text{Conc. Of carotene in sample} \times 1667 = \text{Int. unit of carotene}}{4.53}$$

3.2.6 Vitamin C (Ascorbic Acid) :

Reagents

- a) Metaphosphoric acid – acetic acid extracting solution. The solution was prepared by dissolving 15 g. of glacial H_3PO_3 in 40 ml. acetic acid and 200 ml of distilled H_2O) which was diluted to 500 ml.
- b) Standard ascorbic acid, 45P, ref. L-ascorbic acid.
- c) Standard indophenol solution : 0.05 g. of Na-6-dichlorobenzeno indophenol was dissolved in 50 ml water containing 42 g of NaHCO_3 and shaken vigorously.

Standard ascorbic acid was prepared by dissolving 0.1 g of ascorbic acid, transferred to 100 ml volumetric flask and dissolved in HPO_3 – acetic acid reagent.

Standardization – Three 2 ml aliquot – each of ascorbic acid solution was transferred to three 50 ml erlenmeyer flask containing 5 ml HPO_3 -acetic acid reagent and titrated rapidly with indophenol solution until rose pink colour persists for at least 5 seconds.

Blank samples were simultaneously run with 7 ml HPO_3 -acetic acid reagent and water.

Indophenol Solution (Conc.) :

(expressed as mg. Ascorbic acid = standardization titratum – blank (Av. Value)

The sample solution was prepared as advocated by A.O.A.C. method.

CHAPTER - IV

RESULTS AND DISCUSSION

CHAPTER – IV

RESULT AND DISCUSSION

The results of the data obtained in the present investigation has been divided into two sub-heads :-

- 1) Qualitative data
- 2) Quantitative data

The biographical data in relation to three income group of pregnant and lactating mother in terms of percentage (%) is given in table 1. As is evident the higher percentage of women of these two categories fall in lower income groups followed by middle and higher income groups for this data 150 respondents were studied.

Table 1 : Income group of pregnant women and lactating mothers.

Income group	Total number of respondents	Percentage
Low Income	60	60
Middle Income	50	50
High Income	40	40
Total	150	150

Total Chi – square	=	48.360
Degree of freedom	=	2.0
Probability	=	0.00

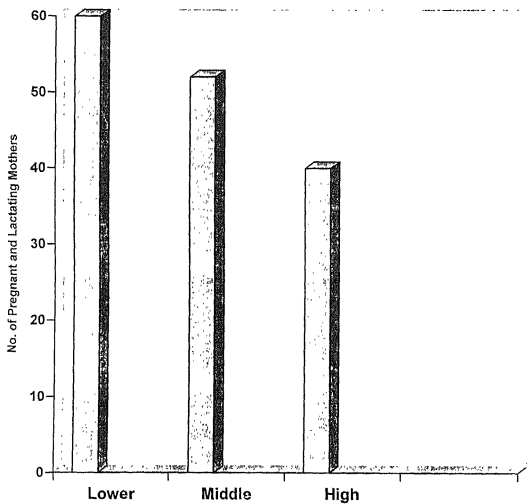


Fig.1: Respondent in three income groups of pregnant and lactating mothers.

4.1 Family structure of the respondents :

The family structure of the respondent is shown in table 1 (a).

Table 1 (a) : Income group wise family structure.

Income Group	Family Structure		
	Joint	Nuclear	Total (%)
Low Income	86.67	113.33	100
Middle Income	76.0	24.0	100
High Income	32.5	92.5	100
Total Chi – square	=	48.360	
Degree of freedom	=	2.0	
Probability	=	0.00	

It is seen from the table that joint family has higher percentage in lower income group followed by middle income and higher income group while reverse is the true in nuclear family structure.

4.1.1 Literacy status :

Nutritional education is essential combating malnutrition and as such should become an integral of all formal educational and relief program. It is seen from table 2 that on the whole the three groups of respondents tended to be low in educational levels, restricted mostly to just junior higher secondary school. However, the lower income group has the lowest literacy percent that is 68.33% followed by middle and higher income group. When we see the table, it becomes clear that the percentage of respondents having just junior high school is almost negligible, which is a matter of great concern in view of the fact that the educational level has direct link with the better nutrition of the family.

Table 2 : Literacy status of pregnant and lactating women.

Income Group	Illiterate	Level of Literacy		
		Just Literate	Up to Primary	Junior High School
Low	68.33	25.0	5.0	1.66
Middle	18.0	10.0	36.0	36.0
High	10.0	10.0	20.0	60.0
Total Chi – square		=	149.516	
Degree of freedom		=	6.0	
Probability		=	0.00	

4.1.2 Occupational pattern of respondents :

The hypothesis that there would be a uniform proportion of the present type of occupational pattern in all cases is rejected at 4% level of significance. The observations show groups but the percentage of housewife is highest in higher income group but the percentage of worker is highest in lower income group women.

Table 3(a) : Occupational structure of respondents (%).

Occupation of respondents	Income group		
	Low	Middle	High
House wives	35.0	76.0	80.0
Worker	64.0	60.0	2.0
Service	1.0	4.0	18.0
Total Chi – square		=	126.14
Degree of freedom		=	4.0
Probability		=	0.00

4.1.3 Occupational pattern of family :

In table 3(a) the occupational pattern of pregnant and lactating mother has been depicted. The table shows that the family who are of lower income group has got maximum number of workers followed by middle income and higher income group⁹. The persons occupation in service and business is highest i.e. 35 and 32% respectively in high income group and the least in lower income group.

Table 3(b) : Family occupation of the pregnant and lactating mothers.

Occupation	Income group		
	Low	Middle	High
Farming	40.0	40.0	27.5
Worker	53.33	14.0	5.0
Service	5.66	28.0	35.0
Business	1.0	18.0	32.0
Total Chi – square	=	53.757	
Degree of freedom	=	6.0	
Probability	=	0.00	

4.1.4 Birth and mortality position :

Although the percentage of born children occupies highest number in lower income group but the percentage of survival is lower as compared to high and lower income group. Like wise miscarriages and abortions figures are also higher in lower income groups. This is evident due to problem of hunger and under nutrition/malnutrition of both categories of women manifested itself in several ways. In a family with limited food availability both in quantity and quality this type of

ailments are frequently seen. It is a matter of great concern that the two groups of women are the most vulnerable.

Table 4 : Children birth and mortality position in the sample (pregnant and lactating women).

Birth and mortality	Income group		
	Low	Middle	High
Children born	80.00	78	75
Children surviving	41.67	58	62.5
Miscarriages	18.33	14	10.0
Abortions	13.33	12	5.0
Total Chi – square = 10.68			
Degree of freedom = 6.0			
Probability = 0.0459			

4.1.5 Kitchen gardening and milch animal :

Both the groups of women under three income group level differ markedly in respect of kitchen gardening and milch animals position. The position of lower income group women is disparately inferior as the percentage of kitchen gardening is lowest that is 12% as compared to 28% and 34% in high and middle group women respectively. Milch animals owned by lower and middle group family is highest whereas high income groups own only 1/3rd as compared to these two groups in view of the fact that nutrition problem is more prevalent in lower and middle group family but it may be possible that the milk consumption is lowest in lower income group family.

Table 5 : Ownership of milch animals and kitchen gardens of pregnant and lactating women (%)

Kitchen gardening and milch animals	Income group		
	Low	Middle	High
Kitchen gardening	12.0	34.0	28.0
Milch animals	22.0	22.0	8.0
Total Chi - square = 7.582			
Degree of freedom = 2.0			
Probability = 0.0029			

4.1.6 Expenditure on food items :

Table 6 depicts the percentage expenditure on different food items of all the three group of women under the present investigation. The percentage of income spent on vegetables, fruits and vegetables, sugar and oil and milk and milk products is almost negligible and altogether absent in low income group women. The high income group category spent their higher percent of income on these items. A cursory glance of the table further reveal that only 5% of respondents spend only 10% of their income in milk and milk product. This figure is also quite low for the consumption of fruit and vegetables. The pattern of spending for different types of foods, fruit shows a changed pattern.

Table 6 : Percentage of total monthly income spent on food items consumed.

Food Items	Percentage of income spent (Rupees)	Income Groups		
		Low	Middle	High
Cereals	10	13.34	24.00	25.00
	25	66.67	60.00	50.00
	>25	20.00	16.00	25.00
Legumes	10	50.00	70.00	80.00
	25	--	24.0	20.00
	>25	--	--	--
Fruits & Vegetables	10	8.33	70.0	47.5
	25	--	30.0	45.0
	>25	--	--	7.5
Sugar and Oil	10	18.33	72.00	52.5
	25	--	14.00	30.0
	>25	--	--	17.5
Milk & milk Products	10	5.00	60.00	70.00
	25	--	18.00	17.5
	>25	--	78.00	5.0

4.1.7 Foods consumed by pregnant and lactating mothers :

Table 7 shows that the food habits of pregnant and lactating mothers in three income categories. The consumption of vegetarian foods is almost double in lower income group family as compared to middle and high income groups. But the non-vegetarian foods is only 1.0% in lower income groups which is 22 times and 17.5 times more in

middle and high income categories respectively. The habits of egg consumption is on the other hand is high in lower income groups which is 12.33%. The nutritional problem leading to protein malnutrition is highest in low income group family as is evident from the table.

Table 7 : Food habits of pregnant and lactating mothers (%).

Food habits	Income group		
	Low	Middle	High
Vegetarian	86.66	42.0	40.0
Non-vegetarian	1.0	22.0	17.5
Vegetarian + Egg	12.33	36.00	32.5
Total Chi - square	=	54.565	
Degree of freedom	=	4.0	
Probability	=	0.00	

4.1.8 Food habits :

Table 8 shows that 65% women of both categories and only 8% and 2% take two times meal per day but the percentage of women in lower income groups who take two times meal is only 2% as compared to 18% and 57.5% in middle and high income group respectively. The adequate food consumption is, thus, lowest in women who are economically poor.

Table 8 : The meal intake frequency of pregnant and lactating mothers.

Meal intake frequency/day	Income group		
	Low	Middle	High
Two times	65.0	8.0	2.0
Three times	32.0	74.0	40.5
More than three	2.0	18.0	57.5
Total Chi - square	=	34.0	
Degree of freedom	=	4.0	
Probability	=	0.00	

4.1.9 Foods avoidance by pregnant women :

Table 9 depicts a wide range of food items avoided during pregnancy and by lactating mothers while the 18.33% women in low income group avoided radish, 10.0 and 2% women in high and middle groups avoided potato from their meal. The avoidance of jack fruit is also high by high income and low income groups. Banana consumption was also avoided largely by low income group women. Similar trend of investigation was also reported by All India Research Project Report (ICAR, 2002).

Table 9 : Foods avoided during pregnancy.

Food stuff	Income group		
	Low	Middle	High
Raddish	18.33	0	0
Potato	0	2.00	10.00
Papaya	21.66	0	17.50
Banana	18.33	0	5.00
Jaggery	5.00	14.00	32.50
Jack fruit	0	22.00	27.50
Garlic	38.33	6.00	32.50
Sonth (dry ginger)	11.67	22.00	22.50
Total Chi – square	=	24.40	
Degree of freedom	=	4.0	
Probability	=	0.00	

4.2 Nutritional pattern of women :

Data was collected with regard to food related activities such as floor kneading, rice and pulse crushing, vegetable washing and

methods of cooking. Qualitative improvement of food stuffs through such processes are needed to bring about palatability of foods as well as nutritive values.

Nutritive value of bread prepared in homes could be increased with little change in the kneading process of wheat/maize and bajra flour by women. In the present study, the data collected are given in table 10. The data shows that higher percentage liked kneading flour with water only. In lower and middle income groups no one adopted the process with ghee (fat).

In the preparation of rice, the data shows arbitrary trend. In the cooking process, the higher percentage of women in low income groups preferred indigenous method of cooking. The adoption of cooking with cooker pressure is however, greater in high income group women. The cooking is associated with beneficial and adverse effects on nutritive value of foods. Hence, there is need to persuade and demonstrate about the method of cooking food items particularly vegetables and pulses due to high losses of protein values.

Table 10 : Methods of cooking food items.

Cooking methods	Income Groups		
	Low	Middle	High
Floor kneading			
a) Water + Ghee	--	--	5.0
b) Water only	100.00	100.00	82.50
c) Water + Salt	--	--	12.50

Contd..

Rice washing			
a) Once	10.00	12.00	57.00
b) Twice	56.66	58.00	12.50
c) Thrice	33.33	30.00	30.00
Pulses washing			
a) Once	32.50	30.00	42.00
b) Twice	61.00	50.00	47.00
c) Thrice	16.66	20.00	10.00
Cooking			
a) Indigenous	85.00	60.00	25.00
b) Pressure	15.00	40.00	75.00
Vegetables washing			
a) Before cooking	33.33	60.00	62.50
b) After cooking	66.66	40.00	37.50
Type of cutting			
a) Small pieces	76.66	50.00	55.00
b) Big pieces	23.33	50.00	45.00
Cooking			
a) Indigenous	80.00	60.00	42.50
b) Pressure	20.00	40.00	57.50

The consumption of cereals is high (315 g) in lower income group but its value is the same (850 g) in middle and high income groups.

4.2.1 Intake of leaf and rooty vegetables :

The data presented in table 13(a) and 13(b) shows relative consumption of leafy and rooty vegetable. The lowest percentage (18.3) consumed leafy and rooty vegetable (53.33). The percentage of this value in high income group is almost 100 percent in low income groups.

Table 11 : Consumption of cereals in g. capita⁻¹day⁻¹ by pregnant women.

Income Groups	No. of respondents	Percentage of women consuming	Average intake
Low	60	100	315
Middle	50	100	250
High	40	100	250

Table 12 : Consumption of pulses (Dal) capita⁻¹ day.

Income Groups	No. of respondents	Percentage of women consuming	Average intake
Low	60	50.0	10
Middle	50	94.0	35
High	40	100	65

Table 13(a) : Intake of leafy vegetables g capita⁻¹ day⁻¹.

Income Groups	No. of respondents	Percentage of women consuming	Average intake
Low	60	18.3	35
Middle	50	46.0	100
High	40	95.0	100

The quantities of fruits and milk and ilk products are also very high in high and middle income groups as is clearly evident from Table 14 and 15. These values are too low in the other group of pregnant women.

Table 13 (b) : Intake of rooty vegetables g capita⁻¹ day⁻¹.

Income Groups	No. of respondents	Percentage of women consuming	Average intake
Low	60	53.33	30
Middle	50	84.0	65
High	40	100.0	70

Table 14 : Quantity of fruits g capita⁻¹ day⁻¹ consumed by pregnant and lactating women.

Income Groups	No. of respondents	Percentage of women consuming	Average intake
Low	60	8.33	10
Middle	50	22.0	75
High	40	75.0	100

Similar is the trend in the consumption of sugar and fats and oils (Table 16 and 17). The comparative average value of these food items shows twice and thrice intake of sugar and thrice and four times of fats and oils in middle and high income groups as compared to low income group women.

Table 15 : Consumption of milk and milk products g capita⁻¹ day⁻¹.

Income Groups	No. of respondents	Percentage of women consuming	Average intake
Low	60	5.0	50
Middle	50	>8.0	200
High	40	100.0	300

Table 16 : Amount of sugar consumed g capita⁻¹ day⁻¹.

Income Groups	No. of respondents	Percentage of women consuming	Average intake
Low	60	18.33	12
Middle	50	86.0	25
High	40	100.0	40

The low intake of animal protein is negligible in low income group pregnant women which is alarming in view of its biological value and protein deficiency in majority of women of poor socio-economic groups.

Table 17 : Consumption of fats and oils g capita⁻¹ day⁻¹.

Income Groups	No. of respondents	Percentage of women consuming	Average intake
Low	60	8.33	10
Middle	50	16.0	30
High	40	47.5	40

4.2.2 Food consumption during lactation :

The table 20 shows total food consumption of different food items of three categories of lactating women. It is seen that the consumption of curds, butter milk is almost negligible in the first category of

mothers. Similar trend is also noticed in the intake of green leafy vegetables. A cursory glance of the table would further reveal that the other food items consumed by low income groups are also low. This has definitely affected the infants born to this categories of women.

Table 18 : Consumption of animal protein g capita⁻¹ day⁻¹ by pregnant women.

Income Groups	No. of respondents	Percentage of women consuming	Average intake
Low	60	0	--
Middle	50	36.0	40
High	40	32.5	100

3774-20
5839

4.2.3 Particulars of obstetric history :

Most mothers were found to be in normal health categories in high income groups and occasional illness was noticed most (35%) in low income groups and middle income groups (26%). The data with respect anemia, body aches, indigestion, odema, and bleeding were found highest in low income group women, as regards immunization of tetanus it is highest in high income groups which clearly shows proper health concern of this group of women. It is further seen from the table that routine health check up if not practiced and it is linked with higher illiteracy percent. Thus, routine check up is as much as 82.5% and 64.0% in high and middle income groups respectively. The matter of supplement foods in regard to calcium, iron and vitamins, the lower income group women shows low percentage of consumption of this vitamins and minerals.

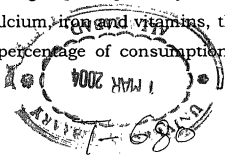


Table 19 : Particulars of obstetrics history of pregnant women (%).

Obstetrics history	Income Groups		
	Low	Middle	High
Health			
a) Normal (%)	48.33	64.0	82.5
b) Occasional illness (%)	35.00	36.0	17.5
Types of illness			
a) Anemia	85.0	78.0	62.50
b) Vomiting	21.67	30.0	50.00
c) Body aches	20.00	14.0	10.00
d) Indigestion	25.00	22.0	7.50
e) Oedema	33.33	26.0	17.50
f) Breathlessness	15.00	14.0	7.50
g) Bleeding	11.67	4.0	12.50
Immunization			
a) Tetanus taken	25.0	64.0	95.0
b) Tetanus not taken	58.33	36.0	5.0
Health check up			
a) Routine check up	--	64.0	82.5
b) Occasionally	18.33	20.0	17.5
Taking supplements			
a) Calcium	5.0	46.0	80.0
b) Iron	15.0	36.0	72.50
c) Vitamins	--	14.0	42.50

4.3 Anthropometric measurements :

Table 21(a) gives the average length, height of newborn of different income groups. It is interesting to note that the average length of newborn infants is at poor (48.05 cm.) with the standard value (50.0 cm.), but the average length of infants is disparately low (40.53 cm.) in lower income group women. Thus, the value in this category falls below the standard value.

Table 20 : Total food consumption during lactation (gday⁻¹).

Food stuffs	Income Groups		
	Lower	Middle	High
Family diet			
Special diet			
a) Black gram dal	25.0	34.0	50.0
b) Curds	3.33	100.0	18.75
c) Butter milk	0	10.0	25.0
d) Dry fruits	0	20.0	62.5
e) Egg	0	0	150.0
f) Fruits	16.67	150.0	250.0
g) Ghee	8.33	20.0	37.5
h) Gond laddus	3.33	20.0	37.5
i) Sonth (dry ginger)	8.33	14.0	17.5
j) Jaggery	16.67	30.0	37.5
j) Green leafy vegetables	0	20.0	62.5

Table 21(a) depicts the average weight of newborns. In the first group infants shows that the average weight of new born in high

income group is little low (2.45 kg) as compared to the standard average weight of 3.0 kg however, the average weight value is still lower than 2.0 kg in lower income group.

Table 20 (a) : Height and weight of the pregnant women.

Income Groups	No. of Respondents	Av. Height (cm.)	Av. Weight (kg.)	Standard Average	
				Height (cm.)	Weight (kg.)
Low	60	160.2	44.07	64.40	1.523
Middle	50	165.0	50.2		
High	40	168.0	54.25		

Table 20(b) : Haemoglobin % of the pregnant women.

Income Groups	Hb. % (Range)	No. of Respondents	Av. Hb. %	Variance	Standard Deviation
Low	6.0-8.0	37			
	8.1-11.0	20	8.85	6x	2.22
	11.1-13.0	3			
Middle	6.0-8.0	31			
	8.1-11.0	15	9.678	6x	2.57
	11.1-13.0	4			
High	6.0-8.0	13			
	8.1-11.0	16	10.23	6x	3.73
	11.1-13.0	11			

4.3.1 Nutritive value of foods :

Data on the dietary intake from various food items as calculated in terms of energy (Kcal) are presented in table 22(a). The total energy obtained from food items is lower (1480.76) in low income group pregnant and lactating mothers followed by middle (1565.75) and high

(2030.35) income groups. A cursory glance of the figures in the data clearly shows that total energy obtained by low income groups came from cereals, pulses, vegetables and fats and oils. The contribution of meat was negligible.

Table 21(a) : Length (height) of new born in different income groups.

Income Groups	Range (cm.)	No. of respondents	Average length (cm.)
Low	44-45	21	
	46-50	33	40.53
	>50	6	
Middle	44-45	17	
	46-50	20	45.09
	>50	13	
High	44-45	--	
	46-50	25	48.05
	>50	15	

Standard average length = 50.0 cm.

Table 21 (b) : Weight of newborns in income groups.

Income Groups	No. of respondents	Average Weight (kg.)
Lower	60	1.93
Middle	50	2.02
High	40	2.45

4.3.2 Carbohydrates consumption :

It is quite interesting to note from Table 22(b) that the consumption of carbohydrate is of the same order in different income categories of pregnant women. This fact further points that carbohydrate constitute the major food items of low income group are, thus, this food category contribute major energy obtained by women.

Table 22 (a) : Energy (Kcal) obtained from food items consumed by pregnant women.

Food Items	Income Groups		
	Lower	Middle	High
Cereals	1245.4	855.0	613.25
Pulses	33.5	100.5	167.5
Leafy vegetables	9.5	27.0	26.0
Rooty vegetables	29.1	97.0	194.0
Fruits	--	38.25	76.5
Milk and milk products	33.5	13.4	201.0
Fats and oils	45.0	270.0	360.0
Sugars	84.76	214.4	274.1
Meat	--	47.2	118.0
Total	1480.76	1565.75	2030.35

I.C.M.R. R.D.A. = 2525 Kcal day⁻¹.

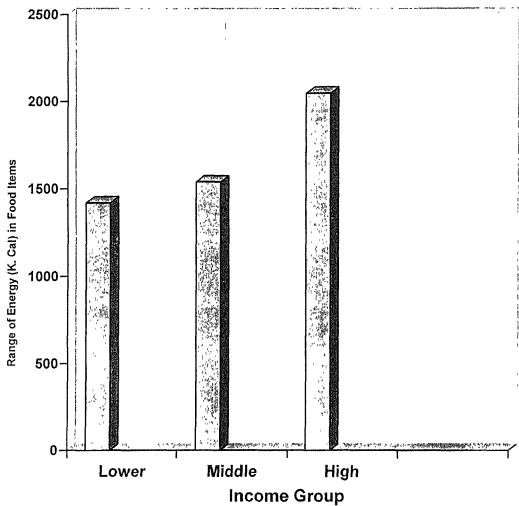


Fig.2: Range of Energy (K. Cal.) in Food Items of Three Income Groups.

Table 22 (b): Carbohydrates content derived from food items (g capita⁻¹ day.

Food Items	Income Groups		
	Lower	Middle	High
Cereals	254.41	160.35	179.15
Pulses	5.76	17.28	2.9
Leafy vegetables	1.02	1.89	22.6
Rooty vegetables	6.78	11.3	16.8
Fruits	--	0.4	--
Milk and milk products	2.2	8.8	16.8
Fats and oils	--	--	13.2
Sugars	9.94	24.45	34.79
Meat	--	--	--
Total	280.11	224.47	286.24

4.3.3 Protein intake :

Table 22 (c) shows the values of protein intake by different categories of women. The total protein consumed by women of low income group is far less (44.01 g day⁻¹) than the recommended daily requirement (ICMR) of (65.0 g day⁻¹). This value is also at par with middle income group, but the total protein consumption by high income group women is, however, at par (64.32 g) with the RDA value. The protein energy malnutrition has been found to be in a desperate level in women. This has largely been attributed due to two main factors viz. poverty and ignorance. Therefore, much stress has been laid to eliminate these causes. The research data obtained by Dougherty and Jones (1982) and Krishnamoorthy (1994) point out to this fact.

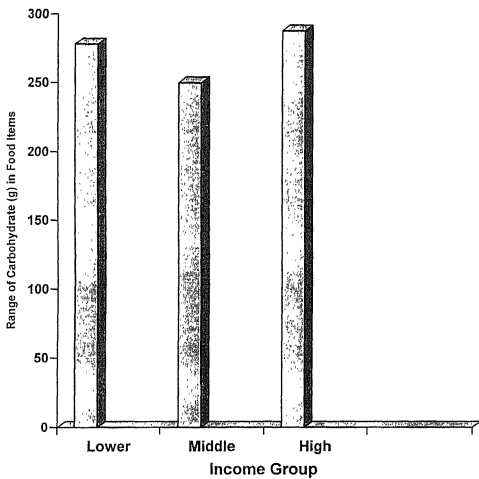


Fig.3: Range of Carbohydrate (g) in Food Items of Three Income Groups.

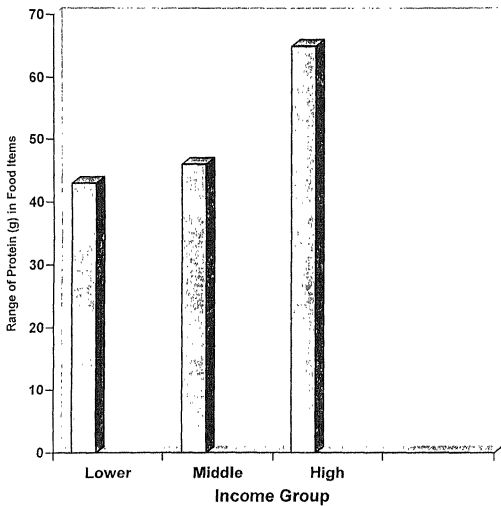


Fig.4: Range of Protein (g) in Food Items of Three Income Groups.

Unfortunately in most communities, dietary protein deficiency is secondary to calorie deficiency (Nutrition Sub Committee, 1972)..

Table 22 (c): Protein content obtained from food items g capita day⁻¹.

Food Items	Income Groups		
	Lower	Middle	High
Cereals	38.25	27.95	34.73
Pulses	2.23	6.69	11.15
Leafy vegetables	1.13	2.05	2.0
Rooty vegetables	0.40	0.8	3.2
Fruits	--	0.67	1.35
Milk and milk products	1.6	6.4	9.6
Fats and oils	--	--	--
Sugars	0.4	0.03	0.16
Meat	--	0.56	2.14
Total	44.01	45.16	64.32

I.C.M.R. R.D.A. = 65 g day⁻¹.

4.3.4 Consumption of fats and oils :

The intake of total fat by all groups of pregnant women has been given in Table 22(d). The total fat intake of first two groups is below the recommended levels of 30.0 g but the figure is above the recommended level is high (57.68 g). This is further seen that total fat consumption of low income group women falls too short of the RDA value. The intake of total fat pattern of high income groups needs to be eliminated in order to prevent some disadvantages, such as coronary diseases which is quite prevalent in high status societies.

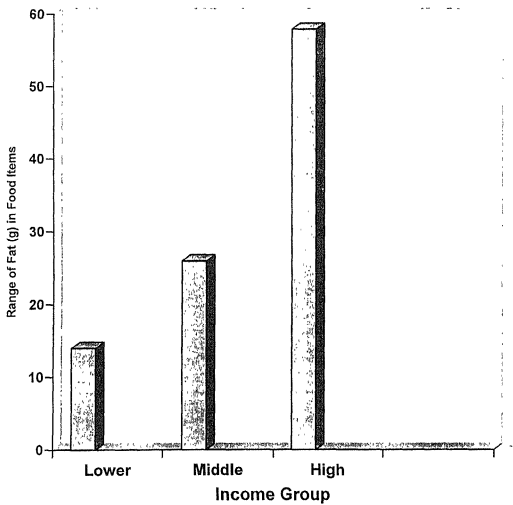


Fig.5: Range of Fat (g) in Food Items of Three Income Groups.

Table 22 (d) : Fat content obtained from food items g capita day⁻¹.

Food Items	Income Groups		
	Lower	Middle	High
Cereals	6.1	3.9	29.25
Pulses	0.17	0.51	1.15
Leafy vegetables	0.17	0.56	0.70
Rooty vegetables	0.03	0.10	0.20
Fruits	--	--	0.45
Milk and milk products	2.05	8.2	12.3
Fats and oils	5.0	10.0	10.0
Sugars	--	0.03	0.03
Meat	--	1.08	3.60
Total	13.52	24.40	57.68

I.C.M.R. R.D.A. = 30 g day⁻¹.

The intake of iron and calcium are of public concern and Table 22(e) and 22(f) gives low content consumption of iron in all the three categories of pregnant women. The intake value is also lower (16.369 mg) in middle income groups than low income groups. This value is also low (27.462 mg) in the high income group women as compared to 38 mg recommended by ICMR. It is well known that this element is required by women, particularly during pregnancy as it is needed for the formation of haemoglobin of red cells of blood besides need for oxidation reduction reactions. The contribution of cereals by low income groups in this respect is noteworthy as 17.55 mg of iron has been provided by cereals as compared to 14.222 mg and 11.400 mg in high and middle income groups women. The intake of cereals, leafy vegetables has also been stressed by Gopalan *et. al.* (1989).

Table 22 (e) : Iron content (mg) obtained from food items by women capita day⁻¹.

Food Items	Income Groups		
	Lower	Middle	High
Cereals	17.550	11.400	14.225
Pulses	0.27	0.81	1.35
Leafy vegetables	1.164	1.905	1.14
Rooty vegetables	0.144	0.48	0.96
Fruits	--	0.202	8.333
Milk and milk products	0.1	0.4	0.6
Fats and oils	--	--	--
Sugars	0.316	1.172	0.854
Meat	--	--	--
Total	19.544	16.369	27.462

I.C.M.R. R.D.A. = 38 mg day⁻¹.

Table 22 (f) : Calcium content derived from food items mg capita day⁻¹.

Food Items	Income Groups		
	Lower	Middle	High
Cereals	173.0	101.0	110.0
Pulses	7.3	21.9	36.6
Leafy vegetables	44.8	56.0	73.0
Rooty vegetables	3.0	10.0	20.0
Fruits	--	7.5	15.0
Milk and milk products	60.0	240.0	360.0
Fats and oils	--	--	--
Sugars	10.8	4.5	28.8
Meat	--	4.8	12.0
Total	298.9	445.7	655.4

I.C.M.R. R.D.A. = 1000 mg day⁻¹.

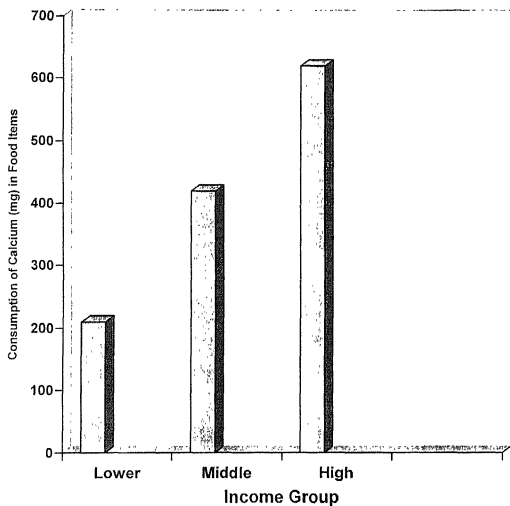


Fig.7: Consumption of Calcium (mg) in Food Items of Three Income Groups.

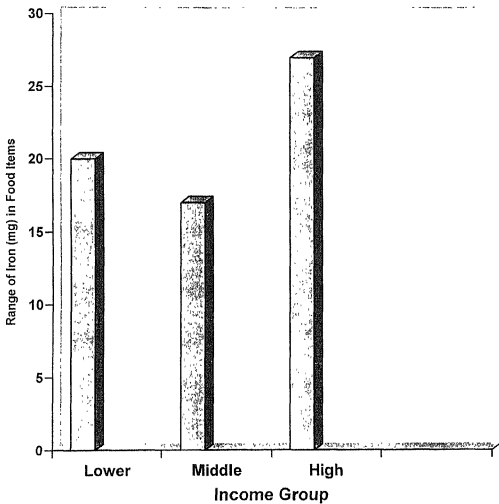


Fig.6: Range of Iron (mg) in Food Items of Three Income Groups.

4.3.5 Calcium derived from food items :-

The calcium intake of low income group is also very low. This mineral was largely derived from cereals the contribution from pulses, rooty vegetables is low which clearly shows that this category of women did not consume sufficient milk and milk product which is largely obtained from these food items. In contrary to this the content of calcium from milk and milk product is higher in middle and higher income groups. Mothers health and probably that of infant severely suffer due to poor calcium nutritional status of the mother. In view of the fact that large proportion of calcium is drained out during the stages of pregnancy and lactation adequate supplement of calcium is essential if sufficient quantity is obtained from food item. Therefore, a generous intake of milk and green leafy vegetable is recommended.

4.3.6 Vitamin A intake per day :

The vitamin A consumption per day as computed from different food items consumed by pregnant and lactating mother is shows in table 22(g). The intake of vitamin A in low income group is highest from consumption of leafy vegetables followed by fats and oils. The pulses did not contribute sufficient quantity which is to also in case of rooty vegetables. It is also interesting to note that there is no contribution from fruits, this is so because low income group women were deprived from fruits as is evident from the table the consumption of milk and milk products, fats and oils are much higher in middle and high income groups. Thus total consumption of vitamin A in high income groups at close with the recommended value 2400 $\mu\text{mg/day}$ however vitamin A obtained from foods is a little low.

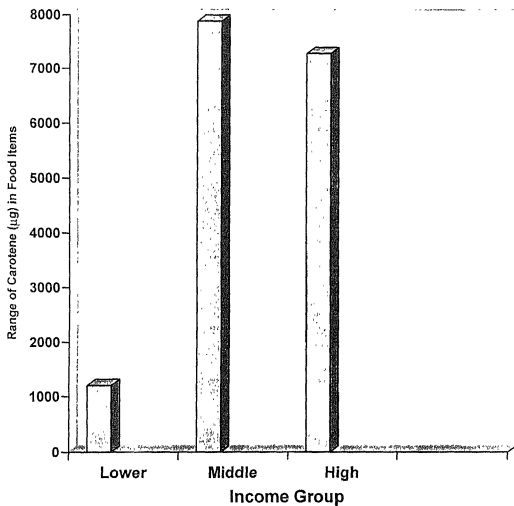


Fig.8: Consumption of Vitamin A (μg) in Food Items of Three Income Groups.

Table 22 (g) : Carotene (Vitamin A) content derived from food items
 $\mu\text{g capita day}^{-1}$.

Food Items	Income Groups		
	Lower	Middle	High
Cereals	101.8	59.0	67.25
Pulses	13.2	99.0	132.0
Leafy vegetables	693.0	795.0	580.0
Rooty vegetables	7.2	24.0	48.0
Fruits	--	--	--
Milk and milk products	87.0	348.0	522.0
Fats and oils	100.0	600.0	800.00
Sugars	--	--	--
Meat	--	--	--
Total	1002.2	1925.0	2140.2

I.C.M.R. R.D.A. = $2400 \mu\text{g day}^{-1}$.

4.3.7 Vitamin C obtained from food items :

The consumption of vitamin C has been shown in Table 22(h) as obtained from different food items. The food items comprised of a different items. The content of vitamin C is different in leafy vegetables, rooty vegetables, fruits and milk and milk products. These food items contributed to vitamin C and the total amount was computed. It is, thus, seen that the total consumption of vitamin C is too low (16.65 mg) in low income group women but the intake of vitamin C is quite adequate to middle income group and high income group which is 206.28 mg and 392.0 mg respectively.

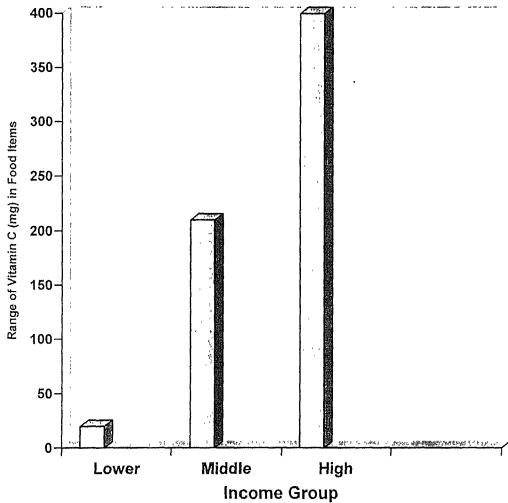


Fig.9: Range of Vitamin C (mg) in Food Items of Three Income Groups.

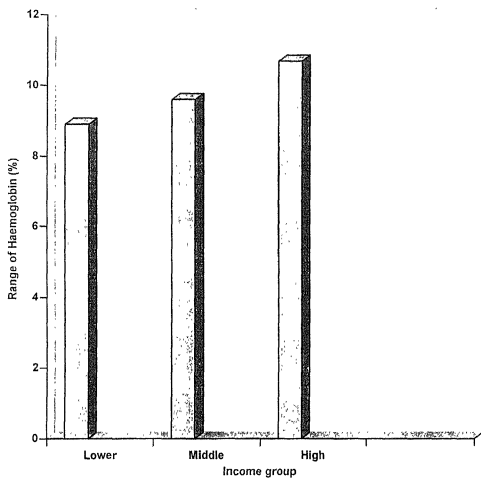


Fig.10: Range of Haemoglobin (%) in Pregnant Women.

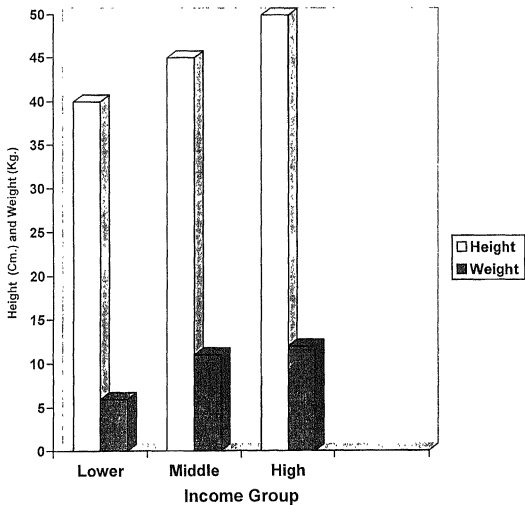


Fig.11: Relationship of Height and Weight of New Born of Three Income Groups.

Table 22(h) : Vitamin C mg content derived from food items capita day⁻¹.

Food Items	Income Groups		
	Lower	Middle	High
Cereals	--	--	--
Pulses	--	--	--
Leafy vegetables	11.55	26.28	28.0
Rooty vegetables	5.1	17.0	34.0
Fruits	--	159.0	318.0
Milk and milk products	--	4.0	6.0
Fats and oils	--	--	--
Sugars	--	--	--
Meat	--	--	--
Total	16.65	206.28	392.0

4.3.8 Feeding frequency of infants :

The frequency of feeding by lactating mothers as given in table 23 clearly shows that higher frequency of feeding was done by low income group women in comparison to high income group women. It is seen that 61.62% women feed their infants more than twice in low income groups while it is only 56.0% and 27.5% in middle and high income group women.

Table 23: Frequency of feeding of infants by lactating mothers.

Income Group	Feeding Frequency		
	Once	Twice	More than twice
Lower	10.0	28.33	61.67
Middle	40.0	24.0	56.0
High	42.5	30.0	27.5

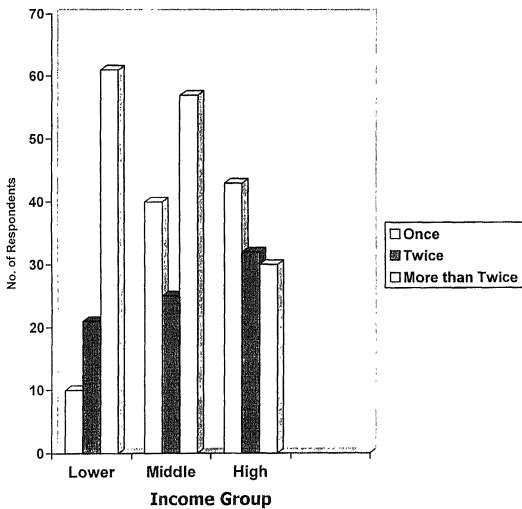


Fig.13: Frequency of Feeding the infants by Three Income Group Women.

4.4 Health status of mothers and development (height) of infants 6 months old :

The health status of mothers and development of infants is further expressed in table 24 which shows that 78.33% of women maintained poor health in low income groups whereas 40.5% women maintained good health in high income groups. This has resulted in better average height of the infants which 46.03 cm., 52.2 cm and 60.43 cm in lower, middle and high income groups.

Table 24: Health status of mothers and development (height) of infants 6 month old.

Income Group	Health Status		Average Height (cm.)
	Poor	Good	
Lower	78.33	21.67	46.03
Middle	60.0	20.0	52.2
High	82.5	17.5	60.43

4.5 Health and development of infants (6 month old):

Table 25: Health and development of infants (6 month old).

Income Group	Health Status			Average Height (cm.)
	Poor	Good	Better	
Lower	50.0	45.0	5.0	5.0
Middle	28.0	40.0	32.0	5.5
High	17.5	32.5	50.0	6.72

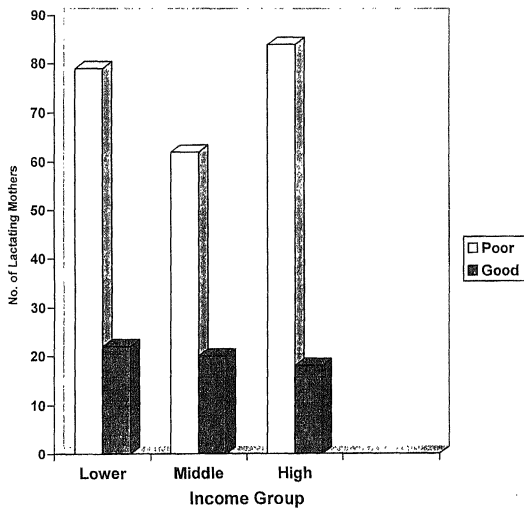


Fig.12: Health and Development of Lactating Mothers in Three Income Groups.

The table 25 depicts the health status and average weight of the infants born to the three income group of pregnant and lactating mothers. The table 25 clearly shows that in lower income group only 5.0% of infants enjoyed better health as compared to 32.0% and 50% of infants in middle and high income groups respectively. The average weight of the infants (0.6 months) is also higher in the high income groups women which is 5.0 kg, 5.5 kg and 6.72 kg in lower, middle and high income groups.

CHAPTER - V

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

Investigations were carried out to study the nutritive value of foods consumed by pregnant and lactating mothers of three locations viz. villages of Chaka Block, two city Hospitals, Kamla Nehru Hospital and Tilak Hospital.

The respondents thus, constituted of two categories of women. The objectives of the study were :

1. To conduct sample survey of women to assess the choices of food consumption.
2. To study the effect of nutritive value of foods on the health of pregnant and lactating mothers.
3. To compare the intake of food stuffs with the standard food values and,
4. To study the impact of food stuffs of consuming women on the health of new born.

The food stuffs were properly sampled and processed in the laboratory for the analysis of various constituents such as carbohydrates, protein, calcium, iron and vitamins. These values were then computed, energy (Kcal) calculated and compared with that recommended by Indian Council of Medical Research for such women. The respondents were timely monitored for their health status. So that after birth the observations of the new born could be recorded. Some values were taken from the city Hospitals from the record files maintained for the purpose.

The major findings and conclusions drawn from the study are presented below :

1. The nutritive value of foods/food items consumed by pregnant and lactating mothers were poor and low as compared to the standard food values.
2. The nutritive value of low income women was much low in comparison to the middle and high income groups.
3. The protein requirement of low income group pregnant women was met largely from the pulses in form of Dal whereas protein requirement of other group women was met by fruits, milk and milk products and non-vegetarian diets.
4. The low intake of protein and vitamins had influenced their health status more than middle and high income groups.
5. The quality of food was found to affect not only the pregnant and lactating mothers but also new born.
6. The low birth weight (LBW) of infants was greatly affected by the food quality consumed by both categories of women.

In view of the results obtained, it is concluded that protein intake during pregnancy and lactation must be increased in low income group women to enable them to withstand the stress of pregnancy and lactation. The foods consumed must be supplemented with vitamins and other essential minerals for these categories of women.

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